(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 190 576**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **86100533.8**

(22) Date of filing: **17.01.86**

(51) Int. Cl.⁴: **B 05 B 15/12**

(30) Priority: **21.01.85 BE 901536**
07.01.86 BE 1011413

(43) Date of publication of application:
13.08.86 Bulletin 86/33

(84) Designated Contracting States:
AT CH DE FR GB IT LI LU NL

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(54) **Method and apparatus for spray-impregnating materials.**

(57) Method for treating building materials by means of the impregnation-technique characterized by spraying an excess of treatment liquid on the pieces which are to be treated. Spraying apparatus, for carrying out the method in accordance with the invention, consisting of a closeable booth (1) and provided with nozzles (13 & 65), a system (2) of tanks, pumps, taps and conduits; characterized by a frame (5) which is movable to and fro within the booth (1) and which carries the nozzles (13 & 65); by the mutual connection conduits of the tanks and by two or more hoses (17 & 50) which are wound on a auto-rewinding hose reel (16 & 51) and which supply the nozzles (13 & 65) with liquid.

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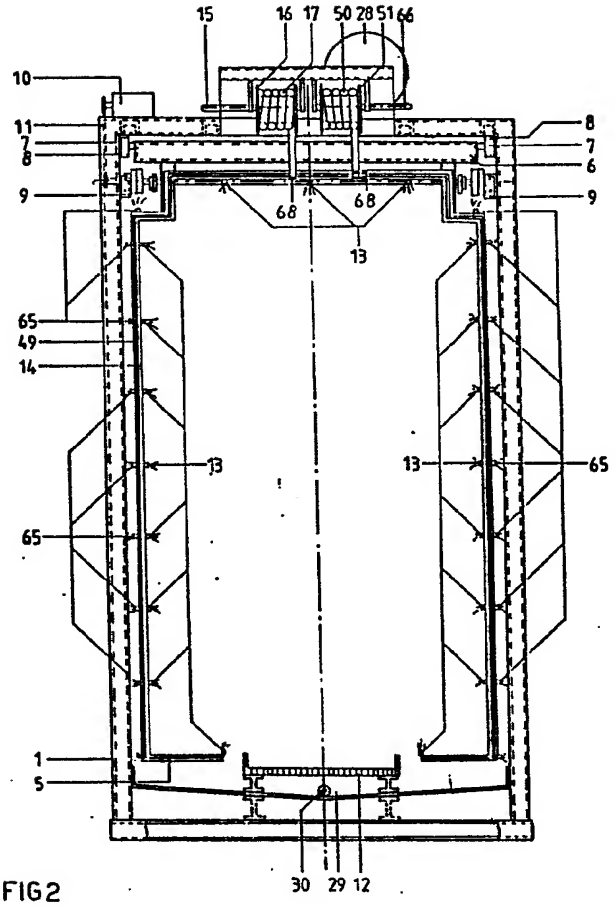
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FIG2

"Method and spraying apparatus for treating building materials, pieces out of wood or other materials in any shape or form, by means of the impregnation-technique".

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Windows, doors, panels and other building elements out of wood or any other material must be treated, on the one side to protect them from the hurtful effects of liquid, worms, fungi and the like ; on the other hand to give these elements a certain colour.

For that purpose, several techniques are available : submersion, injecting, impregnation, expulsion of the sap ; techniques which protect the building elements by means of special treatment liquids. Submersion is a much applied technique, based on impregnation, which offers good results. However, the efficiency of the submersion technique is not very high : the necessary amount of liquid is very large, this large amount is subject to ageing processes because the product isn't undergoing enough renewal, a lot of space is needed when it concerns an automatic transit-system, the vaporization above the surface of the open submersion basin harms the quality of the treatment liquid, is hurtful for the health of people in the proximity of the basin and increases the fire- and explosion-risk.

A second technique based on impregnation is the one by which the building materials are placed into a closeable booth. Spread over the innerwalls of the booth, there are fixed nozzles which are directed inwardly. These known spraying apparatus are based on a method by which the elements are surrounded by a dense cloud of drops of the treatment liquid. In this way an effect similar to the effect obtained by submersion in a basin with treatment liquid, is obtained : not only the surfaces turned to the nozzles, but all surfaces and corners of the elements are steeped with the treatment liquid. Thus, the use of this closed booth is an economical alternative for the open

submersion basins.

However, these machines with fixed nozzles still need a relative large stock of treatment liquid which is expensive and which is the object of ageing processes changing the characteristics of the solution. Also the maintenance of the nozzles by means of dissolving solvents is difficult, so that often only one type of treatment liquid can be used. Moreover , these booths are not suitable for the use of pigmentated products. The removal of resin from the nozzles isn't possible neither.

The method in accordance with the invention for treating building materials, windows, doors, panels, all kinds of woodwork and other pieces out of wood or out of other materials ; is characterized by surrounding with intervals the elements with a cloud of drops of treatment liquid : periods in which the booth is filled with such a cloud are alternated with periods without supply of treatment liquid. By doing so, the treatment liquid gets time to impregnate in the elements, and the excess of treatment liquid gets time to run down from the surfaces. The treatment liquid which lands on the elements during the following spraying period, finds fairly dry surfaces on which no layer of treatment liquid is to be detected, under itself, so that the impregnation can act again. This method of successive impregnation waves, caused by surrounding discontinuously with a dense cloud of drops of the treatment liquid, results in a bigger impregnation depth or a better protection of the elements.

The method in accordance with the invention can be carried out by the current spraying-devices with fixed nozzles spread over the innerwalls of the booth, by activating with intervals the pump or pumps which supply the nozzles with treatment liquid.

The problems with the large stock of treatment liquid, the maintenance of the nozzles, the restriction to only one type of treatment liquid and to colourless

treatment liquids, are not solved in this way.

The spraying apparatus in accordance with the invention, based on the method in accordance with the invention, is intented to remedy the higher mentioned problems. The spraying apparatus in accordance with the invention allows to treat the elements with all existing treatment liquids, thus even those treatment liquids with volatile components with a low inflaming temperature or with pigments and resinous components. This means that the treatment liquid has a certain colour and gives this colour along with the materials. The improvements even allow to use several colours by turns with one spraying apparatus.

The spraying apparatus in accordance with the invention for treating building materials, all kinds of woodwork and other pieces out of wood or out of other materials is characterized by a frame which is movable to and fro within the booth and which carries the nozzles.

The spraying apparatus in accordance with the invention is further characterized by two or more hoses which are wound on an auto-rewinding hose reel and which forms the connection between the nozzles on the moving frame and the fixed tanks.

Furthermore, the spraying apparatus in accordance with the invention is characterized by the connection conduits which link up the different tanks, comprising solvent and treatment liquid, mutually and which allow the liquid to be transferred in a specific direction.

For example, without any restricting character, a detailed description of a possible embodiment of an apparatus in accordance with the invention for applying the method in accordance with the invention follows hereafter. This description refers to the accompanying drawings, in which :

Fig. 1 is a schematic representation of a possible implantation of the spraying apparatus in accor-

dance with the invention.

Fig. 2 is a vertical cross-section of the spraying booth of the spraying apparatus in accordance with the invention.

Fig. 3 is a schematic top-view of the whole of tanks, pumps and conduits of the spraying apparatus in accordance with the invention.

Fig. 4 is a perspectif view on a possible embodiment of the drive of the frame of the spraying apparatus in accordance with the invention.

Booth (1) (fig. 1), made of resistant material, is provided on its both sides with a door (4), this allows the elements, to be treated, to be brought in on one side of the booth (1), and the treated elements to be taken out on the other side. The described case of the booth (1) has the shape of a rectangular parallelepiped. It is also possible to provide the booth (1) with only one door (4).

Next to the booth (1), the system (2) of tanks, pumps, conduits and steering valves is set up. Further, a steering panel (3) is provided.

As represented on fig. 2, a frame (5) is provided within the booth (1), frame (5) which is hung up to a waggon (6)which is hung up on four wheels (7). These wheels (7) rest two by two on profiles (8), fixed on the walls over the length of the booth (1) (also fig. 4). Along these profiles (8), runs an endless chain (9), which is set into motion by an electromotor (10), placed outside the booth (1), by way of a transmission belt (11).

The frame (5) forms within the booth (1) an inscribed rectangle. On the frame (5), a tube (14) is provided, which supplies the nozzles (13), which are directed inwardly. Furthermore, a second tube (49) is provided on the frame (5), which supplies the second series of nozzles (65) which are directed to the outerwalls and to

the chain (9).

Spraying the treatment liquid by means of nozzles mounted on a frame moving to and fro, results in two problems. On the one side there's the problem of driving the frame, on the other hand there's the problem of supplying the nozzles with treatment liquid or solvent.

As certain components of the treatment liquid, a.o. the solvent which dilutes the treatment liquid, are volatile and have a low inflaming temperature, it is absolutaly necessary to close the booth (1) during, and to provide the booth (1) with fresh air after spraying, and to keep all electric parts out of the booth (1). This to avoid that a possible spark should make explode the gasmixture within the booth (1). These requirements bring along certain problems concerning the drive. Chains (9) (fig. 4), which transmit the movement of the electromotor (10) to the frame (5), cannot move to and fro as this implies the provision of switches within the booth (1) to reverse the movement of the electromotor (10) at the end of each movement-direction of the frame (5). This continuous movement of the chains (9) must be reversed into a movement to and fro of the frame (5) by means of a transmission. For this purpose, a connectionhook (52) is mounted on both sides of one or more links of the chains (9). On these connectionhooks (52) a carrierbar (53) is mounted, on which sits a roller (54). This roller (54) is found between the four sides of the frame (55), mounted on frame (5). This frame (55) allows the roller (54) to pass over the difference in height between the upper side (56) and the lower side (57) of the chain (9). This roller (54) takes along the frame (55), and thus the frame (5), during its movement to and fro on the chain (9). Such a chain (9) is provided on both sides of the booth (1) , so that the carrierbar (53) connects both chains (9) and on both sides of the frame (5) a frame (55), in which a roller (54) is found, is mounted, so that the

frame (5) is pulled forward symmetrically by means of both frames (55). Possibly only one frame (55) can be provided in the middle of the frame (5). It suffices then to place one chain (9) in the middle, against the ceiling of booth (1).

The chain (9) runs around chain-wheels (58). On the spindle of chain-wheel (58), a second chain-wheel (59), driven by a chain (60) out of the main spindle (61) with chain-wheel (62), is mounted. The main spindle (61) runs through the wall of the booth (1) and is driven on his turn by means of a transmission belt (11) out of the electromotor (10), placed outside the booth (1). Fig. 4 further shows the profiles (8) on which the wheels (7) of the small waggon (6) run.

The problem of supplying the nozzles, is solved by means of two or more hoses (17 & 50) (fig. 2) which are windable on two or more auto-rewinding hose reels (resp. 16 & 51). Such an auto-rewinding hose reel (16 & 51) consist of a fixed axial tube (resp. 15. & 66) functioning as a spindle around which the hose reel (resp. 16 & 51) rotates; and of a springsystem, worked in within the hose reel (16 & 51), which makes the hose (resp. 17 & 50) being rewinded automatically when the distance between the extremity of the hose (17 or 50) and the hose reel (16 or 51) becomes smaller. The extremity of the hose (17 or 50) acts respectively as the discharge or the supply. These hose reels (16 or 51) can be mounted on the frame (5) or the waggon (6). The axial pipes (resp. 15 & 66) act then as the discharge of the hoses (resp. 17 & 50) and thus supply to the tubes (14 & 49) on the frame. The extremities of the hoses (resp. 17 & 50) act then as the supply or receive solvent or treatment liquid from the pumps. The hose reels (16 & 51) can also be mounted in the booth (1), as represented on figure 2 where both hose reels (16 & 51) are worked into the ceiling of the booth

(1), the axial tubes (resp. 15 & 66) act then as supply, the extremities of the hoses (resp. 17 & 50) are then the discharge or supply to the tubes (14 & 49) on the frame (5).

The springsystem in the hose reels (16 & 51) allows the hoses to be unrolled when the frame (5) moves away from the hose reels (16 & 51). The springtension is in such a way that both hoses (resp. 17 & 50) are rewound on the hose reels (resp. 16 & 51) under the reverse movement. This system prevents the hoses (17 & 50) to fling about within the booth (1).

The first hose (17) is connected only with the first tube (14) with the nozzles (13) which are directed inwardly. This first hose (17) supplies only treatment liquid. The second hose (50) is connected with both tubes (14 & 49) and supplies only solvent. Both hoses (17 & 50) are connected with their respective tubes (14 & 49) by means of repercussion-valves (68).

At the bottom of the booth (1), a gutter (29), sloping towards the middle of the booth (1) breathwise and towards the drainconduit (30) lengthwise, is provided. A grating (12) is placed above the gutter (29), which allows the to be treated elements to be placed in the booth (1) or to be driven in or out the booth (1) before and after the treatment, hung up on one or more special carts.

The booth (1) is further provided with one or more ventilators (28) which draw off the developed vapours and blow in fresh air when the treatment or cleaning process is finished. The ventilators (28) are activated each time one of the doors (4) is opened, for safety reasons.

The system (2) (fig. 1) of tanks, pumps and conduits (fig. 3), which supplies to the axial tubes (15 & 66) (fig. 2), consists substantially of at least one tank (21) for the treatment liquid, a tank (22) for polluted

solvent and a tank (23) for clean solvent ; of a pump (24) for the treatment liquid and a pump (25) for the solvent, polluted or clean ; and of a number of connection conduits and a number of steering valves. The term polluted solvent indicates that solvent which is already mixed with an amount of treatment liquid, as it has already served several times for cleaning the booth, the nozzles and the conduits which are in common for solvent and treatment liquid. The term clean solvent indicates that solvent which isn't mixed with treatment liquid.

As represented on figure 3, a connection conduit (31) links both tanks (22 & 23) with a first steering valve (32) which is linked with a second steering valve (34) via connection conduit (33), which leads the liquid through pump (25). Steering valve (34) supplies in one position to the axial tube (66) (fig. 2) via conduit (41) and in the other position to a third steering valve (35) via a connection conduit (36). Steering valve (35) supplies in one position to tank (22) via a connection conduit (37) and in the other position to tank (21) via a connection conduit (38). The possible flowdirections in these connection conduits (31, 33, 36, 37, 38) and conduit (41) are indicated with an arrow. Conduit (41) leads successively through a manometer, a tap, a filter, a tap and a manometer ; indicated on figure 3 with number 39. The connection conduit (63) links tank (21) via pump (24) with a steering valve (42) which supplies in one position back to tank (21) via connection conduit (64) and in the other position to conduit (44) connected with axial tube (15) (fig. 2). Conduit (44) leads successively through a manometer, a tap, a filter, a tap and a manometer ; indicated on figure 3 under number 40. On the other side of the tanks (21, 22 & 23) a drainage conduit (30) (fig. 2) arrives at a steering valve (43) which supplies in one position to tank (21) via connection conduit (69) and in the other

position to steering valve (45) via connection conduit (46). Steering valve (45) supplies to tank (22) via connection conduit (47) or to tank (23) via connection conduit (48), dependent on her position. In order to facilitate the rest of the description, the position of a steering valve (32, 34, 35, 42, 43, 45) drawn in full line on figure 3 will be indicated with position A, the position in dashline with position B.

This arrangement of the tanks, pumps, steering valves and connection conduits allows the following possibilities. On the one side : supply of treatment liquid to the nozzles (13) via conduit (44), axial tube (15) and hose (17) by means of pump (24) if steering valve (42) is set in position B. The surplus of liquid, which flows off the walls of booth (1) and off the treated elements, returns via gutter (29) and drain conduit (30) (fig. 2) to tank (21), if steering valve (43) is set in position B. With steering valve (42) in position A, the treatment liquid is pumped about via connection conduits (63 & 64), what allows the treatment liquid to be mingled. This can be neccessary when the treatment liquid must be diluted or when certain components of the treatment liquid are settled down, e.g. after a period during which the spraying appartus hasn't been used.

On the other hand : supply of solvent to the nozzles (13 & 65) via conduit (41), axial tube (66) and hose (50). This is important to prevent the treatment liquid ; consisting of a pigmentated oil-like solution, which contains thus resins ; from stopping up the nozzles (13) or tube (14) or from forming a layer on the walls of the booth (1) or on the chains (9) when the spraying apparatus is inactive during a certain time. After the termination of production period, first polluted solvent is pumped out of tank (22) through nozzles (13 & 65), with steering valve (32) in position B and steering valve (34)

in position A by means of pump (25) and via conduit (41). The pollluted solvent dilutes the major part of the remaining treatment liquid in booth (1), and returns via drain conduit (30), via steering valve (43) in position A and steering valve (45) in position B to its own tank (22). After that, the same is done with clean solvent with steering valves (32, 34, 43 and 45) all in position A. When the level in one of the tanks (21, 22, 23) becomes too low, the connection conduits allow the solvent to be transferred. When the level of the treatment liquid becomes too low, treatment liquid under concentrated form must be added and this concentrated liquid must be diluted with polluted solvent. By means of pump (25) and steering valves (32 & 34) in position B and steering valve (35) in position A, the polluted solvent is pumped from tank (22) to tank (21). After this, everything needs to be well mingled in tank (21), this is possible with connection conduits (63 and 64) and steering valve (42) in position A. When the level of the polluted solvent becomes too low, tank (22) can be replenished with clean solvent by means of pump (25) and steering valve (32) in position A and steering valves (34 and 35) in position B.

The levels of tanks (21, 22 or 23) can be read visually, by means of a float or a gauge-glass, or can be continously registrated by electrical means. The steering valves can be hand operated or operated full automatically by steering panel (3). This steering panel (3) steers, on the basis of the chosen program : treatment of elements or cleaning the booth (1) or other procedures, the steering valves, pumps (24 & 25), the electromotor (10) and ventilator (28). The program for treating the elements can for example consist of :

1th : Spraying : pump (24) and electromotor (10) work.

2th : Pause : the treatment liquid gets the time

to impregnate in the wood, the excess flows down of the walls and elements and returns to tank (21).

3th : Ventilation : sucking up the developed vapours and furthering the drying by means of ventilator (28).

The duration of each part of this program can be programmed in advance on steering panel (3) which watches the levels in tanks (21, 22 & 23). The program continously controls if the steering valves are in the right position, so that the liquid returning from the booth (1) always returns to its own tank (21, 22 or 23). This protection is imperative to avoid that the treatment liquid should be made useless by adding wrongly an excess of solvent.

It's obvious, more than two tanks (22, 23) can be provided for the solvent to divide it in more than two grades of pollution. By adjusting the number of pumps, steering valves and connection conduits, the solvent can be transferred to a tank of higher pollution.

To enable the use of two or more treatment liquids with a different colour, two or more tanks (21) must be provided and for each treatment liquid a separate hose reel (16), with a hose (17), which supplies to tube (14), via a repercussion valve (68), a seperate pump (24), steering valve (42), connection conduits (63 and 64) and conduit (44), with a system (40) of taps, filters and manometers, must be provided. In this way the supply of the different treatment liquids is separated completely, except for the tube (14) and the nozzles (13). However, these can be cleaned with solvent, thus mixture of the colours is prevented. The frame (5) can possibly be provided with a separate tube (14) with nozzles (13) for each colour, in order to separate the different colours completely. The treatment liquid which stands still between a pump (24) and a repercussion valve (68) in a conduit (44) and

a hose (17) cannot harden as everything is airtight.

The spraying apparatus in accordance with the invention with the frame (5) movable to and fro and the continuous spraying nozzles (13) combines the advantages of method in accordance with the invention, viz. surrounding the elements discontinuously with a dense cloud of treatment liquid drops, with the advantages which the limited number of nozzles (13) for the treatment liquid entails.

Due to the second series of nozzles (65) and the supply of solvent via hose (50) to both tubes (14 & 49) or to both series of nozzles (13 & 65), the booth (1) is perfectly cleanable inside. Solvent and treatment liquid are supplied totally seperated, except for the tube (14) and nozzles (13). The connection conduits which link up the tanks (21, 22 & 23) mutually, allow an economical use of the solvent. The possibility to bring the elements in or out of the booth (1) by means of carts or racks, allows to use these carts or racks as stockage before or after the treatment and for the further finishing. Endless stacking up and unloading and the labour involved in doing so, is avoided in this way.

C L A I M S.

1. Method for treating building materials, all kinds of woodwork and other pieces out of wood or other materials by means of the impregnation-technique characterized by discontinuously spraying an excess of treatment liquid on the elements which are to be treated.

2. Method according to claim 1 wherein the succession of spraying periods and intervals are automatically and adjustable steered.

3. Spraying apparatus for treating building materials, all kinds of woodwork and other pieces out of wood or other materials by means of the impregnation-technique consisting of a closeable booth (1) and provided with nozzles (13 & 65), a system (2) of tanks, pumps, taps and conduits ; characterized by a frame (5) which is movable to and fro within the booth (1) and which carries the nozzles (13 & 65).

4. Spraying apparatus according to claim 3 wherein said frame (5) with said nozzles (13 & 65) follows round the section of booth (1).

5. Spraying apparatus according to claims 3 and 4 wherein said frame (5) with said nozzles (13 & 65) is hung up to a waggon (6) with four wheels (7), which rest two by two on parallel profiles (8), fixed on two parallel walls of said booth (1), said waggon (6) is set into motion by means of one or two endless chains (9), of which one chainwheelspindle is driven by an electric, pneumatic or hydraulic motor.

6. Spraying apparatus according to claims 3 or 4 wherein the frame (5) is provided with two series of nozzles (13 & 65) each mounted on a separate tube (resp. 14 & 49) which are both mounted on frame (5), of which the first series of nozzles (13) are directed to the middle of booth (1) and which supply treatment liquid

and solvent ; and of which the second series of nozzles (65) are directed to the outerwalls of booth (1) and to the chains (9) and which supply only solvent.

7. Spraying apparatus according to claims 3, 4 or 6 wherein the system (2) of tanks consists out of one ormore tanks for each treatment liquid with a different colour and of two or more tanks for solvents with different grades of purity ; characterized by the connection conduits which link up the different tanks in such a way, via one or more pumps, that it is possible to transfer solvent with a certain grade of purity to a tank comprising solvent with a lower grade purity or to a tank comprising treatment liquid.

8. Spraying apparatus according to claims 6 or 7 wherein each tube (14 & 49) is supplied by means of a hose (17 or 50) on a hose reel (resp. 16 & 51) which is provided with a springsystem in such a manner that the hose (resp. 17 & 50) can unroll freely and is rewinded when the distance between both extremities of the hose becomes smaller due to the movement of the frame (5) which carries nozzles (13 & 65).

9. Spraying apparatus according to claim 8 wherein the first hose (17) is connected with tube (14) and with pump (24) for the treatment liquid.

10. Spraying apparatus according to claim 8 wherein the second hose (50) is connected with both tubes (14 & 49) and with pump (25) for the solvent.

11. Spraying apparatus according to claim 9 wherein for each treatment liquid with its own colour, a hose (17) is provided, which is connected with one of the tanks comprising treatment liquid via a pump and which supplies to tube (14) with nozzles (13) on the moveable frame (5).

12. Spraying apparatus according to claims 8, 9, 10 or 11 wherein the hoses (17 & 50) are connected with tubes

(14 & 49) by means of a repercussion valve (68).

13. Spraying apparatus according to one of claims 3 to 12 wherein the position of the steering valves, the levels of the tanks, the electromotor (10), pumps and ventilator (28) are steered and controlled automatically.

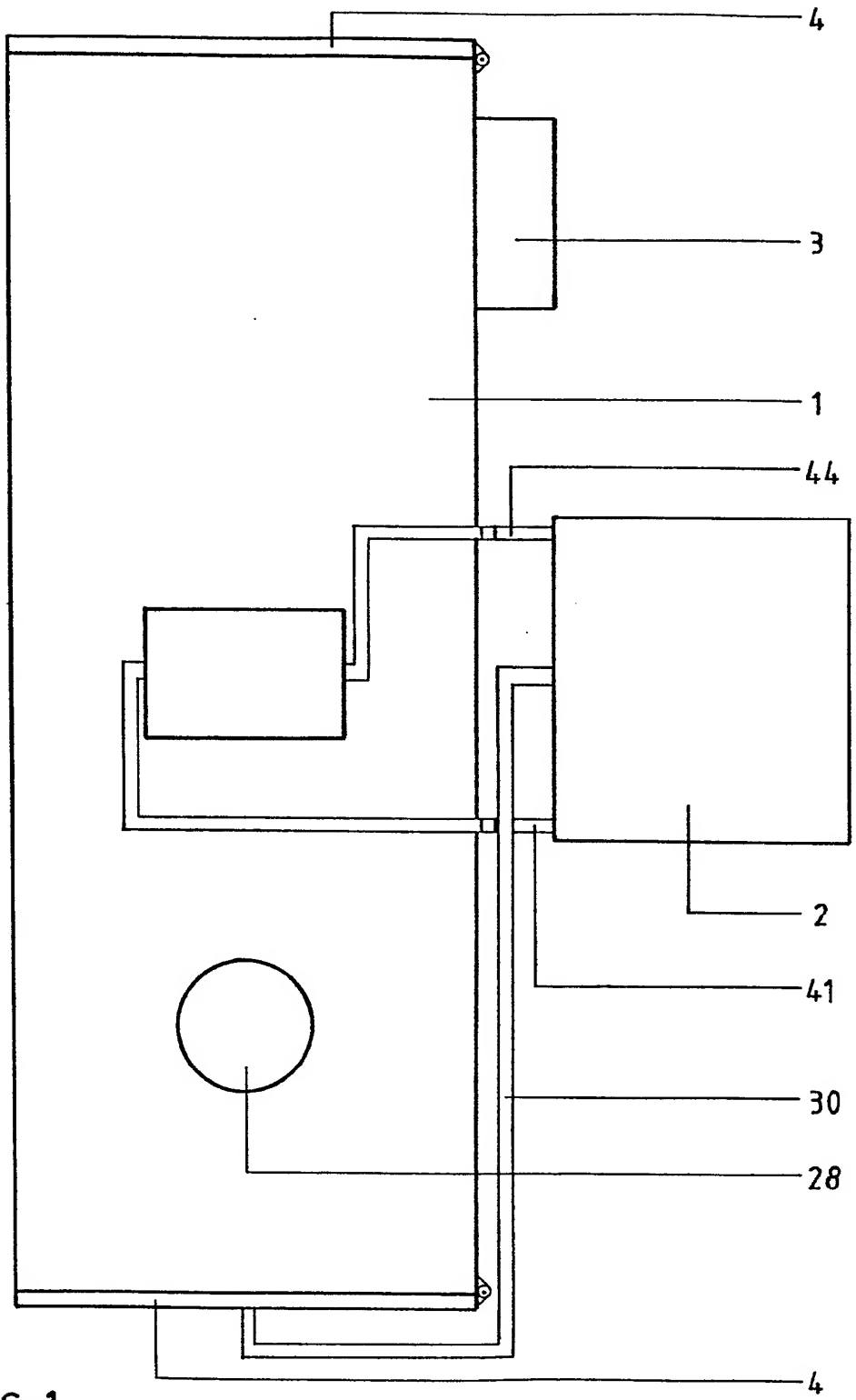

FIG.1

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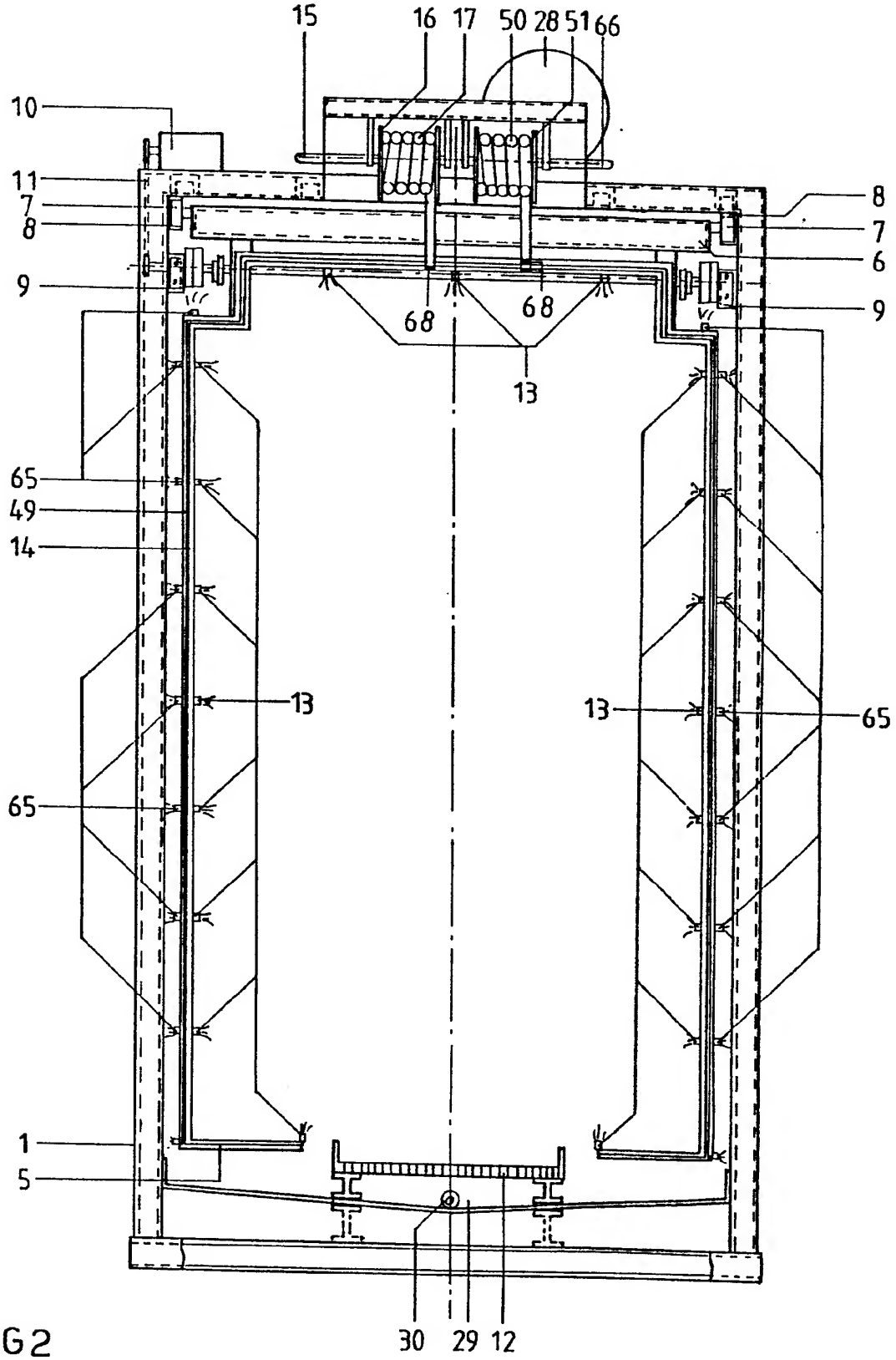

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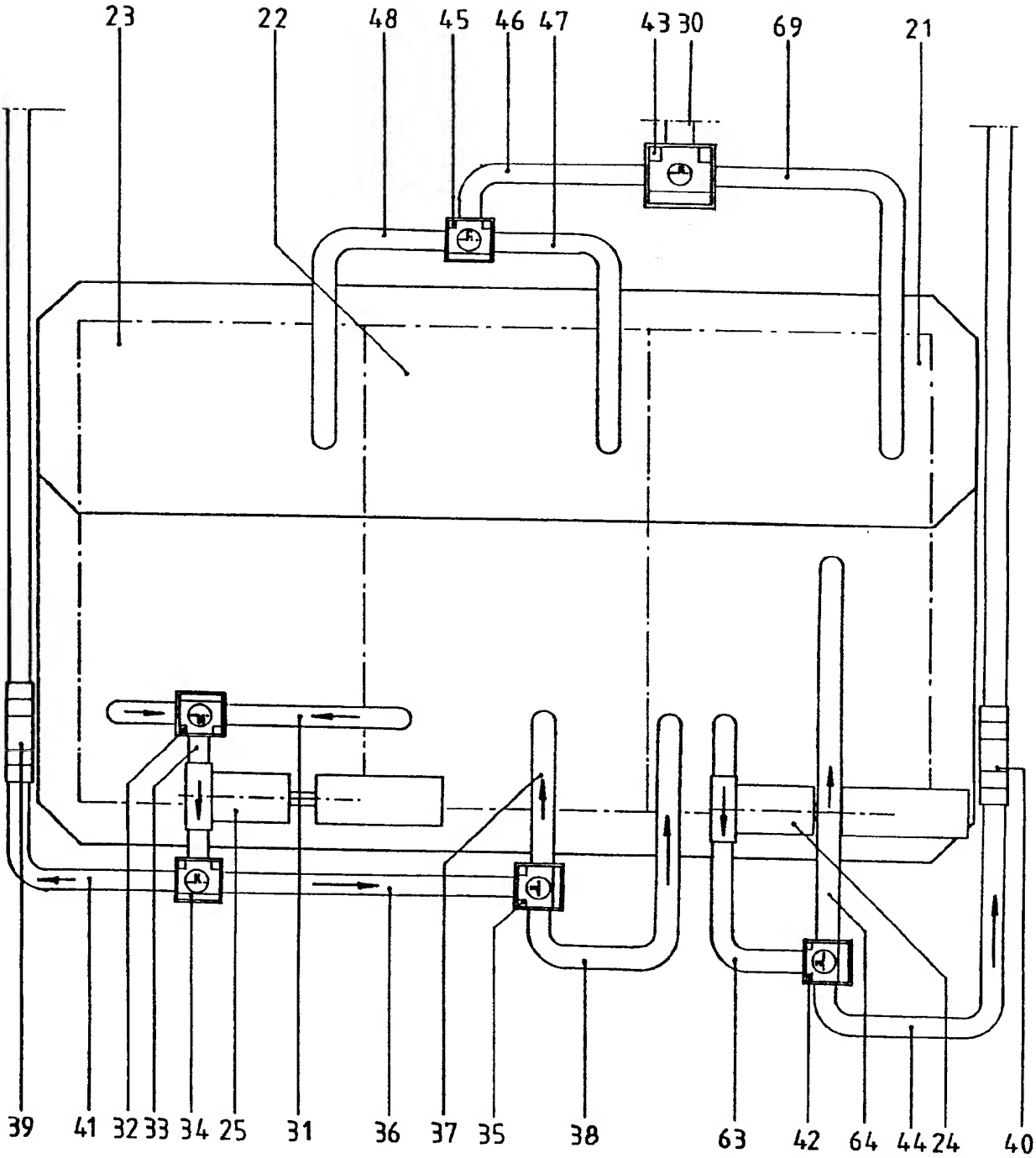
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FIG. 3

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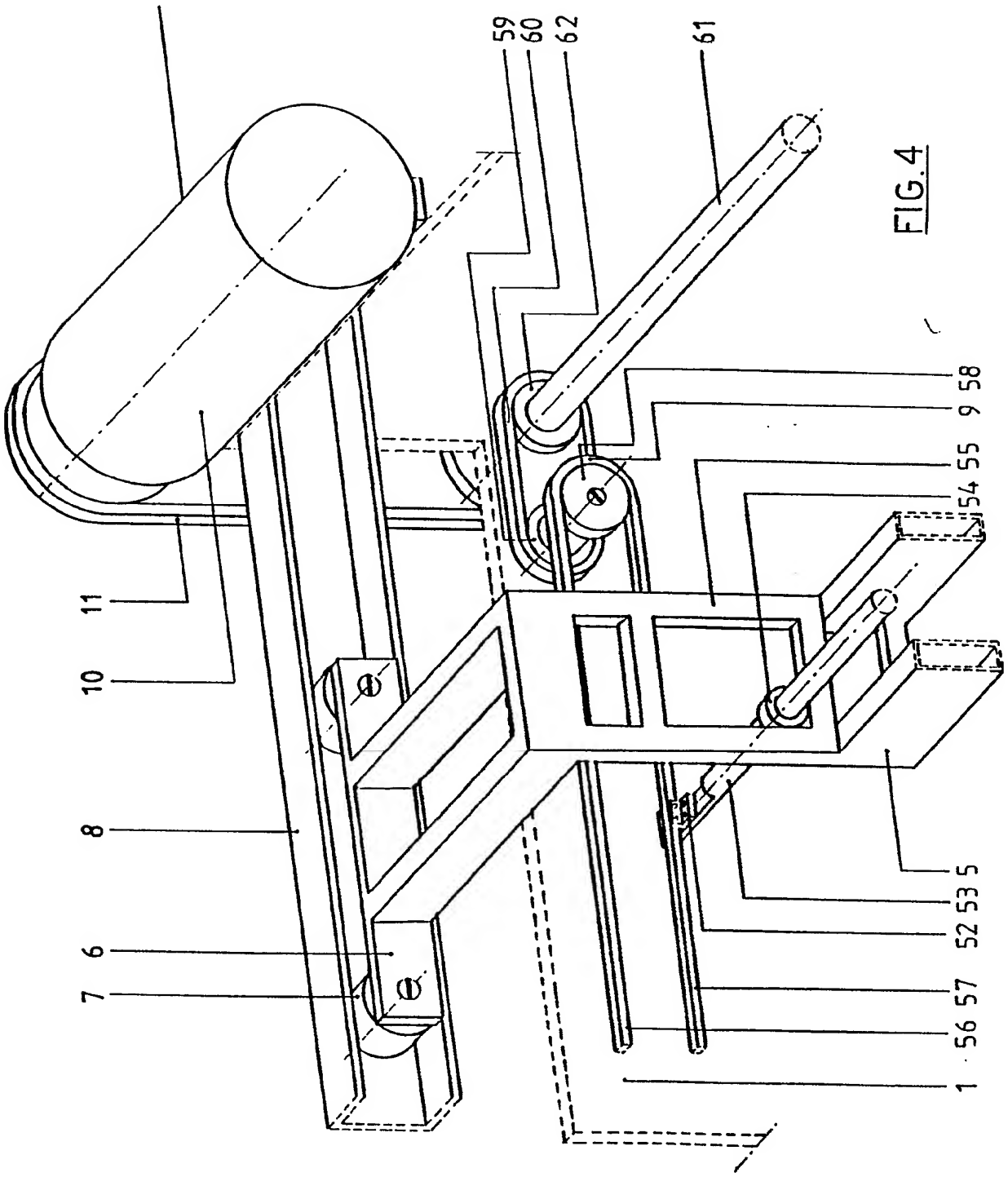

FIG.4